of fifteen miles from Altyn-mazar. The length of this glacier is not less than twenty to twenty-five miles, and it is fed with several other glaciers of very large size. The oscillations in its length have a great importance, as sometimes it advances so far into the valley as completely to bar up the valley of the affluent of Sel-su, the Baland-kiik; this last thence forms a wide base which afterwards cuts through a passage in the ice and inundates the main valley, destroying the forests; now the glacier is once more in advance, and has nearly barred up the valley of the Baland-kiik. M. Oshanin proposes to give to this glacier—probably the second or third in size in Central Asia—the name of "Fedtchenko-glacier." As to the vegetation of its neighbourhood, it is very poor, the bottom of the valley being covered only with brushes of *Tamaris* and *Atraphaxis*, whilst the lateral valley of the Baland-kiik, although far higher than that of Sel-su, is covered with rich forests and grass. The season was too late for affording opportunities to collect insects, but M. Oshanin observed immense quantities of the *Microplax interrupta*, Fieb., in the neighbourhood of Altyn-mazar. This *Oxycerenina*, which is characteristic of the southern parts of the paleoarctic region in Europe, reaches in Central Asia such heights as in the Alps and Pyrenees are occupied with representatives of the Arctic zone. After having uselessly attempted to penetrate further into the high regions at the sources of the Baland-kiik, M. Oshanin was compelled to return, having thrown but a glance on this region of glaciers.

NORDENSKJÖLD has met with a warm reception at Lisbon. We have already spoken of the honour done him at Naples, and the honours which await him in France. Amsterdam has invited him, Copenhagen will intercept him on his way home, and in Sweden he will doubtless receive a worthy reception. What is our own Geographical Society to do? We hear of no preparations being made for the reception of one of the greatest and most modest of explorers. Wherever he has touched, Nordenskjöld has had honours showered upon him by the governments of the country; but we suppose it would be "bad form" in an English government to show anything like enthusiasm on behalf of science; though there is no saying, the Swedish explorer may, after all, become the fashion for a week.

AT the meeting of the Geographical Society on Monday next, Mr. E. Hutchinson, the Lay Secretary of the Church Missionary Society, will read a paper on the ascent of the Binué branch of the Niger, by the missionary steamer *Henry Venn*, in August of last year, supplementing his account of this exploration by remarks on the systems of Rivers Shari and Binué.

WE understand that the Free Church of Scotland have received from Mr. James Stewart, C.E., of Livingstonia, an account of his recent exploratory journey from the head of Lake Nyassa, to the south end of Lake Tanganyika, where he arrived on the afternoon of November 5. Great interest will attach to this report, as we believe that for two-thirds of the way Mr. Stewart's route was considerably to the westward of Mr. Thomson's, and that he met with much less difficult country, and which had, in fact, a very gradual rise and descent. This, no doubt, will account for the erroneous statement first received by telegram from Mozambique, that Mr. Thomson had found the country level between the two lakes.

THE principal original paper in the new number (85) of the *Zeitschrift* of the Berlin Geographical Society is the interesting journal of the late Dr. Erwin von Bary, kept during his journey from Tripoli to Ghät and Aïr. There is a fine new map of the Fagüm, by Dr. Schweinfurth, after the survey of Rousseau Bey, in 1871; Dr. Schweinfurth promises a paper discussing several points connected with the geography of the district. In No. 27 of the *Verhandlungen* Dr. Rohlfs furnishes an account of his recent journey to the Oasis of Kufra; a series of barometrical measurement of heights, of Col. Prjevalsky, in Central Asia, is given.

WITH the current number of *Les Missions Catholiques* is issued an interesting map of a portion of Eastern Equatorial Africa, which has been prepared by Père F. Charmetaut, who went to Africa to organise the first Algerian missionary expedition to the lake region. The features of the country between the coast and Lake Tanganyika are shown in considerable detail, and the routes followed by the Algerian missionaries to Ujiji and Lake Victoria are also laid down. Père Charmetaut bases his map to some extent on special information which he claimed to have obtained in Africa.

WE regret to hear that Père Ruellan, who was a member of the second Algerian missionary expedition to East Central Africa, died at Tabora, on November 24, of typhoid fever. Before leaving for Zanzibar last summer, Père Ruellan, with one of his colleagues, was sent to Paris to the Natural History Museum, and the Montsouris Observatory, in order to take lessons in practical geography, astronomy, natural history, &c. Père Ruellan promised to be an energetic geographer, for on the journey to Mpwapwa his first thought on arriving in camp was always to determine the position of the locality, and he looked forward to being able to render useful service to the science of ethnography in Eastern Africa.

DR. MATTEUCCI, the well-known Italian traveller, who recently left Rome on a journey of exploration in Africa, in company with Prince Borghese, has arrived in Cairo, where he has had the good fortune to meet Mgr. Guillaume Massaja. From Mgr. Massaja's long practical knowledge of Abyssinia and the Galla country, Dr. Matteucci would, no doubt, obtain from him much valuable information respecting those regions, which Italian travellers are beginning to affect as their own particular field of exploration.

FROM the *Colonies and India* we learn that a scientific survey of the district of the Chaudière River, in Canada, is about to be made in search of the deposits of gold which are said to have been found on both banks of the river. The country is chiefly forest land, and some of the timber-getters there have met with nuggets of gold. The River Chaudière rises some 120 miles south of Quebec, and empties into the St. Lawrence, nearly opposite that city.

THE January number of the *Boletin* of the Madrid Geographical Society is largely occupied with three *Memoirs*, accompanied by two excellent charts of the Passage Islands, in the West Indies, two of the *Memoirs* being devoted to the Island of Culebra.

ON THE BAROMETRIC SEE-SAW BETWEEN RUSSIA AND INDIA IN THE SUN-SPOT CYCLE

IN his Report on the Meteorology of India in 1877, Mr. Eliot drew attention to the fact that throughout that year the pressure of the atmosphere, as shown by the barometric registers of all parts of India, was more or less in excess of the average; at some places absolutely without intermission (on the means of the several months), at other places with slight and comparatively insignificant interruptions. He also pointed out that this condition was not restricted to India, but appeared to have prevailed also in the distant regions of New South Wales and Victoria, where, however, the oscillations were greater and its continuity more interrupted.

In point of fact this condition of excessive pressure lasted not less than two years in the Indian region, having set in between May and August, 1876, and continued to between May and August, 1878, after which for many months the pressure was as persistently and strikingly below the average as it had exceeded it during the period in question. It included two years of serious failure of the rains, first in the Peninsular and afterwards in the Gangetic provinces. Further examination has shown that the condition of excessive pressure prevailed over not only the Indo-Malayan region and Eastern Australia, but also the greater part if not the whole of Asia, probably the whole of Australia and the South Indian Ocean (at least as far as the Mauritius), but in the extra-tropical regions of both hemispheres it was subject to considerable variations, which were but faintly reproduced in the tropics. As the result of an inquiry into the characteristic features of this widely extended atmospheric condition, pursued back into past years, I have been led to some preliminary conclusions which seem to me of much interest, not only in themselves, but also as opening up a field of research which may be profitably extended to other quarters of the globe. It may be stated at the outset that as regards the Indo-Malayan region, and perhaps also South-Eastern Asia generally, the excessive pressure of 1876-78 was in part the maximum phase of a cyclical oscillation; but that as regards Northern Asia, and probably also Australia, it was anomalous and apparently non-periodic, and even in the Indo-Malayan region, it was probably to a considerable extent of this character also.

With respect to the cyclical oscillation, which appears to conform to the sun-spot period, one or two facts have already been noticed in the pages of NATURE by Mr. F. Chambers (vol. xviii. p. 567), and Mr. Archibald[1] (vol. xx. p. 28); but those which I have now to bring forward will serve to give it greater precision, and a much more extended basis, and they serve also to throw some slight additional light on the nature of the agency by which the oscillation is effected, and which has, I think, been misapprehended by one if not both of the above writers. In the present communication I shall restrict myself to this subject, reserving the more abstruse question of the anomalous element for future discussion.

To begin with the most regular and uniform case of variation, that of an insular station situated almost on the equator. The barometric register of Singapore in lat. 2° (elevation 10 feet above sea-level) gives the following deviations from the several monthly averages since its commencement in 1869.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Mean	29·892	29·894	29·877	29·840	29·836	29·851	29·858	29·863	29·875	29·868	29·865	29·873
1869	—	—	—	—	- ·012	- ·025	- ·020	- ·015	- ·009	- ·015	- ·009	- ·037
1870	- ·093	- ·060	- ·055	- ·043	- ·038	- ·035	- ·035	- ·084	- ·031	- ·022	- ·015	- ·012
1871	?	?	?	?	?	?	+ ·004	- ·007	- ·022	- ·024	- ·025	+ ·007
1872	- ·003	- ·024	- ·004	- ·021	0	- ·035	- ·020	- ·025	- ·021	- ·024	- ·056	- ·043
1873	- ·041	- ·029	- ·025	- ·014	- ·030	- ·024	- ·018	- ·015	- ·008	- ·015	+ ·019	- ·003
1874	+ ·062	+ ·030	- ·010	+ ·024	+ ·007	- ·003	- ·008	+ ·016	+ ·004	+ ·014	+ ·040	+ ·043
1875	- ·003	- ·001	+ ·025	+ ·012	+ ·010	+ ·015	+ ·013	+ ·028	+ ·028	+ ·014	+ ·049	+ ·023
1876	+ ·003	+ ·005	+ ·011	0	+ ·033	+ ·030	+ ·032	+ ·023	+ ·025	+ ·040	- ·014	+ ·037
1877	+ ·060	- ·043	+ ·026	+ ·029	+ ·020	+ ·049	+ ·045	+ ·054	+ ·040	+ ·049	+ ·036	- ·003
1878	+ ·015	+ ·033	+ ·036	+ ·016	+ ·002	+ ·005	- ·014	+ ·014	- ·011	- ·028	- ·037	- ·050

I must observe that in 1869 and 1870 the register was taken from the readings of a different barometer from that used subsequently, and no comparison has ever been made between them. There may thus be some small uneliminated error in the figures for these two years, but since both Batavia to the south and Port Blair to the north show a barometric depression in 1870 not less persistent and (in the case of Port Blair) almost as intense, this error can hardly be of importance. The registers of these two latter stations show the following differences. For that of Batavia, I am indebted to the kindness of Dr. Bergsma, who has communicated to me a proof sheet of his forthcoming volume. The values are in millimetres. The Port Blair table is drawn up from the registers in the Calcutta Meteorological Office, reduced to the Calcutta standard and the present elevation of the barometer at 61·16 feet above half-tide level.

BATAVIA (millimetres).

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Means	758·75	758·65	758·68	758·23	758·26	758·78	759·01	759·11	759·20	758·81	758·67	758·42
1866	+0·83	-0·40	+0·38	+0·29	-0·29	+0·34	-0·01	+0·13	-0·12	+0·08	-0·29	+0·59
1867	+1·10	-0·28	+0·79	+0·28	-0·32	-0·15	-0·18	-0·30	-0·52	-0·51	+1·04	+0·75
1868	-0·39	+0·32	+0·44	+0·74	+1·08	+0·76	+0·17	+0·37	+0·37	+0·50	+1·06	+0·52
1869	+1·33	+0·94	+0·15	+0·62	-0·02	-0·09	+0·19	+0·06	+0·32	+0·35	-0·16	-0·28
1870	-1·76	-0·79	-0·65	-0·76	-0·47	-0·45	-0·24	-0·84	-0·17	-0·16	-0·36	-0·19
1871	-0·94	-0·60	-0·17	+0·11	+0·11	-0·13	-0·05	-0·04	-0·25	-0·23	-0·65	+0·08
1872	-0·28	-0·37	-0·28	-0·51	+0·19	-0·78	-0·38	-0·54	-0·55	-0·39	-1·42	-0·94
1873	-0·93	-0·52	-0·54	-0·50	-0·75	-0·17	-0·14	-0·24	-0·14	-0·04	+0·47	+0·18
1874	+0·78	+0·34	-0·89	+0·09	-0·08	-0·43	-0·57	-0·23	-0·48	-0·31	-0·06	+0·13
1875	-0·92	-0·75	-0·31	-0·42	-0·05	-0·28	+0·11	-0·01	+0·11	-0·46	+0·26	-0·73
1876	-0·82	-0·32	-0·55	-0·93	+0·20	+0·02	+0·22	-0·08	+0·07	+0·40	+0·09	+0·83
1877	+1·35	+1·18	+0·71	+0·75	+0·40	+1·28	+1·43	+1·65	+1·38	+1·49	+0·83	+0·21
1878	+0·66	+1·28	+0·98	+0·29	-0·06	+0·15	-0·54	+0·05	-0·37	-0·73	-0·78	-1·18

PORT BLAIR (English inches).

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Means	—	—	—	—	—	—	—	—	—	—	—	—
1868	—	—	—	—	—	+ ·020	+ ·037	+ ·010	+ ·018	+ ·028	+ ·027	+ ·060
1869	+ ·079	+ ·035	+ ·002	+ ·012	+ ·007	- ·022	- ·009	0	- ·007	- ·014	+ ·014	- ·022
1870	- ·083	- ·056	- ·049	- ·032	- ·046	- ·014	- ·033	- ·046	- ·032	- ·017	- ·012	- ·081
1871	- ·043	- ·022	?	?	?	?	+ ·007	+ ·014	- ·011	- ·009	+ ·007	+ ·013
1872	+ ·007	- ·001	+ ·006	- ·023	- ·020	- ·028	- ·021	- ·034	- ·023	- ·034	- ·037	- ·034
1873	- ·032	- ·031	- ·014	- ·012	+ ·007	- ·039	- ·032	- ·011	- ·011	- ·022	+ ·023	+ ·020
1874	+ ·040	+ ·001	- ·026	+ ·018	- ·015	- ·007	- ·013	+ ·005	- ·020	+ ·006	- ·017	- ·050
1875	- ·008	- ·039	- ·019	- ·037	+ ·020	+ ·007	- ·009	- ·001	- ·001	- ·006	?	+ ·025
1876	+ ·007	+ ·013	+ ·002	- ·025	+ ·009	+ ·009	+ ·004	- ·003	+ ·027	+ ·030	- ·005	+ ·052
1877	+ ·082	+ ·045	+ ·039	+ ·055	+ ·035	+ ·046	+ ·048	+ ·035	+ ·076	+ ·081	+ ·051	+ ·028
1878	+ ·039	+ ·054	+ ·060	+ ·046	0	+ ·002	+ ·015	+ ·031	- ·015	- ·017	- ·057	- ·043

The registers of Colombo also (N. lat. 6° 56′) as far as they go, viz., since 1872, show a similar graduated variation, but those of the Mauritius, for which I am indebted to the kindness of Mr. Meldrum, differ considerably, and indicate a pressure below the average in 1867 and 1868, and above it in 1871. In 1876 and 1877, however, they agree with those of the other stations in showing an unusually high pressure. The following table shows the annual deviation of the mean pressure at each of the five stations since the commencement of the registers, all being reduced to English inches.

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[1] Mr. Archibald mentions that the relation discussed was brought to his notice by Mr. S. A. Hill.

	Mauritius.	Batavia.	Singapore.	Colombo.	Port Blair.
Means	30·071	29·871	29·866	29·847	29·804
1861	- ·038	—	—	—	—
1862	- ·036	—	—	—	—
1863	- ·023	—	—	—	—
1864	+ ·011	—	—	—	—
1865	+ ·002	—	—	—	—
1866	+ ·010	+ ·005	—	—	—
1867	- ·004	+ ·006	—	—	—
1868	- ·012	+ ·020	—	—	+ ·029
1869	+ ·013	+ ·011	- ·018	—	+ ·006
1870	- ·003	- ·023	- ·044	—	- ·042
1871	+ ·034	- ·009	- ·011	—	- ·006
1872	- ·006	- ·020	- ·023	- ·020	- ·020
1873	+ ·008	- ·010	- ·017	- ·005	- ·013
1874	+ ·004	- ·006	+ ·018	+ ·003	- ·007
1875	+ ·005	- ·011	+ ·018	- ·004	- ·006
1876	+ ·015	- ·002	+ ·019	+ ·002	+ ·010
1877	+ ·026	+ ·042	+ ·037	+ ·037	+ ·052
1878	- ·010	- ·001	- ·002	0	+ ·010

With the perhaps doubtful exception of the Mauritius, the general conformity of the oscillation shown by these stations to that of the last cycle of sun-spot frequency is sufficiently obvious, without resorting to any expedient for smoothing the minor variations; and it is to be noticed that the maximum pressure coincides approximately with the minimum of sun-spots and *vice versâ*. Other registers, such as those of Akyab and Chittagong on the Arakan coast, of Calcutta and Bombay (as Mr. F. Chambers has shown), and of Darjiling on the Himalaya exhibit a similar oscillation, but more overlaid with irregular variations apparently, the further we recede from the equator. The registers of Calcutta and Bombay reach back to 1853 and 1847 respectively, and thus comprehend three sun-spot minima, and in the latter case three maxima also. The annual deviation of pressure from the general average at each of these two stations is given in the second and third columns of the following table, and in the fourth and fifth columns the smoothed means obtained by substituting for that of each year the mean of three consecutive years. In the last column are given Wolf's sun-spot numbers up to 1875, taken from the revised table published in vol. xiii. of the *Memoirs* of the Royal Astronomical Society.

Year.	From observ.		Smoothed.		Wolf's numbers.
	Calcutta.	Bombay.	Calcutta.	Bombay.	
1847	—	- ·012	—	—	97·4
1848	—	- ·004	—	- ·009	124·9
1849	—	- ·011	—	- ·005	95·4
1850	—	- ·001	—	- ·008	69·8
1851	—	- ·013	—	- ·006	63·2
1852	—	- ·004	—	- ·004	52·7
1853	- ·013	+ ·005	—	- ·001	38·5
1854	- ·002	- ·005	- ·003	+ ·005	21·0
1855	+ ·005	+ ·015	0	+ ·002	7·7
1856	- ·004	- ·003	- ·004	+ 004	5·1
1857	- ·013	- ·001	- ·007	0	22·9
1858	- ·003	+ ·003	- ·002	+ ·002	56·2
1859	+ ·009	+ ·003	- ·004	0	90·3
1860	- ·019	- ·005	- ·011	- ·005	94·8
1861	- ·023	- ·012	- ·020	- ·014	77·7
1862	- ·017	- ·026	- ·021	- ·018	61·0
1863	- ·024	- ·017	- ·010	- ·003	45·4
1864	+ ·011	+ ·023	+ ·002	+ ·003	45·2
1865	+ ·018	+ ·002	+ ·011	+ ·013	31·4
1866	+ ·004	+ ·013	+ ·015	+ ·010	14·7
1867	+ ·022	+ ·015	+ ·016	+ ·018	8·8
1868	+ ·022	+ ·027	+ ·016	+ ·016	36·8
1869	+ ·005	+ ·005	+ ·005	+ ·007	78·6
1870	- ·011	- ·012	- ·005	- ·004	131·8
1871	- ·008	- ·004	- ·005	- ·010	113·8
1872	+ ·004	- ·014	- ·004	- ·005	99·7
1873	- ·008	+ ·002	0	- ·004	67·7
1874	+ ·005	+ ·001	- ·004	+ ·001	43·1
1875	- ·008	0	- ·004	+ ·003	18·9
1876	- ·009	+ ·007	+ ·009	+ ·015	—
1877	+ ·044	+ ·037	+ ·015	+ ·011	—
1878	+ ·014	- ·011	—	—	—

Both the Calcutta and Bombay registers exhibit oscillations of pressure coinciding approximately with those of the sun-spots, and more pronounced in the case of Bombay than in that of Calcutta.[1]

Hence it may be concluded that throughout the Indo-Malayan region there is a cyclical oscillation of atmospheric pressure approximately coinciding with that of the sun-spots, the maximum pressure coinciding with or immediately following the epoch of minimum frequency of sun-spots and the minimum pressure that of the sun-spot maximum. This oscillation is most distinctly and regularly developed at insular stations in the immediate neighbourhood of the equator.

The character of this coincidence is somewhat striking when considered in connection with that established by Köppen in the case of air temperature, and which I may observe has been confirmed by further experience. This is, that the air temperature of the tropics is greatest at the epoch of sun-spot minimum and *vice versâ*. In strict accordance herewith the unusual excess of pressure of 1876-78 coincided with an equally striking and persistent excess of temperature, throughout India and its dependencies. Taking the mean of all the deviations of registered temperatures from the local averages at all the stations enumerated in the Indian Meteorological Reports for the fou years 1875-78 (these averages, be it observed, being deduced from all the existing registers in the case of each station, and not those of the four years only), we have the following results:—

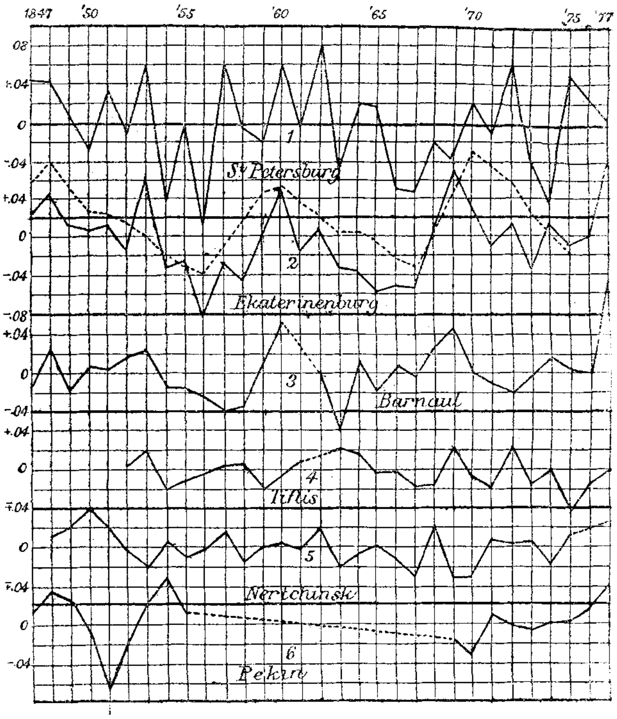

Fig. 1.

Year	1875	1876	1877	1878
Number of stations	72	72	74	74
Mean variation from from average ...	-0°·29	-0°·08	+0° 17	+0°·62
Differences		-0°·21	+0°·25	+0°·45

This apparent anomaly, the co-existence of excessive pressure with excessive temperature is, however, in some measure explained, when the barometric registers of the Indian hill stations are compared with those of the plains. Of these former, Darjiling at 6,912 feet above sea-level has furnished the longest register (viz., for twelve years) and affords the best standard for comparison. On the average of the whole period from May, 1876, to August, 1878, the atmospheric pressure at this level was relatively more excessive than on the plains of Lower Bengal, the mean excess being + 0·0375″ at Darjiling, and + 0·0298″ on the Bengal plains, which stretch away from the foot of the Sikkim Himalaya. Moreover it prevailed more steadily. From August, 1876, to August, 1878, or for twenty-five consecutive months, there was not one in which, at the hill station, the pressure did not exceed the average of the month; whereas on the plains it fell slightly below the average in November, 1876, and also in August and November, 1877. The registers of other hill stations (at least such as are trustworthy) extend over too short a period to furnish a good average; but, as far as their evidence goes, it is consistent with that of Darjiling; and we may therefore draw a second and very important conclusion, viz., *that the excessive pressure of the two years* 1876-1878 *in India was mainly, if not entirely due, to the condition of the higher strata of the atmosphere;* to that portion, at all events, which lies above 7,000 feet. This is very important, and while it explains the apparent anomaly above adverted to, and which in other cases has been emphatically insisted on by the late John Allan Broun, it points a useful caution against the too frequent habit of arguing from conditions of temperature (as observed at the earth's surface) as if the whole thickness of the atmosphere were affected in the like manner.

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[1] A fact noticed in the Bengal Meteorological Report for 1868 points to the inference that the registers prior to 1866 are not perhaps quite so trustworthy on this point as those of Bombay. It is stated that in August, 1866, a crust of mercurous oxide was removed from the surface of the cistern, and inasmuch as this oxide is less dense than mercury (and the readings had always been taken from its surface) it is probable that a sensible error affected all such readings.

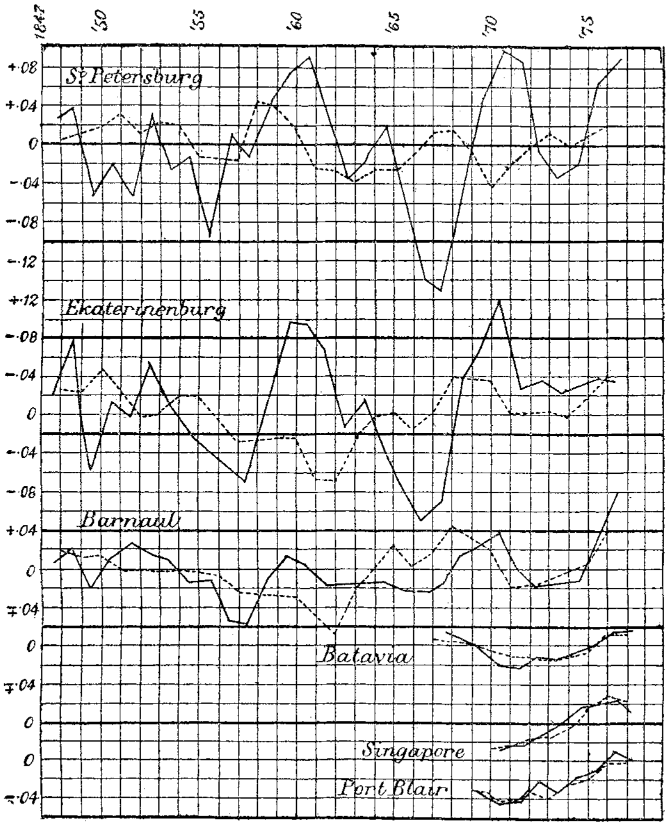


Fig. 2.

Leaving now, for the moment, the Indo-Malayan region, and turning to other parts of the Europe-Asiatic continent, we find in Western Siberia and European Russia, evidence of a cyclical oscillation of pressure, which is of the opposite character to that already noticed. Of all the stations which since 1847 have furnished the registers published in the *Annales de l'Observatoire Central de Russie*, Ekaterinenburg, at the eastern foot of the Ural, is that which exhibits this oscillation in its most salient and regular form. But it is more or less distinctly traceable in the registers of Bogolowsk and Slatoust also in the Ural; of Barnaul at the northern foot of the Altai, and with considerable intensity but much masked by irregular variations in those of St. Petersburg. Tiflis, however, to the south-west, and Nertchinsk and Pekin to the east, show no distinct trace of it. Indeed the somewhat interrupted registers of Pekin give a curve which in some respects rather conforms to the Indo-Malayan type. The accompanying figures 1 to 6 represent the curves of the annual deviation of the mean pressure at the above six stations, up to 1877, and over that of Ekaterinenburg I give a dotted curve showing the variation of the sun-spots. In point of amplitude the oscillation at Ekaterinenburg and St. Petersburg greatly exceeds that of the opposite type in the Indo-Malayan region, as indeed might be expected if these oscillations are reciprocally compensating, and the tropical type prevails over a larger area than the Siberian.

We are thus led to the further conclusion that *between Russia and Western Siberia on the one hand, and the Indo-Malayan region (perhaps including the Chinese region) on the other, there is a reciprocating and cyclical oscillation of atmospheric pressure; of such a character that the pressure is at a maximum in Western Siberia and Russia about the epoch of maximum sun-spots, and in the Indo-Malayan area at that of minimum sun-spots.*

In tabulating the variations of the barometric means of Ekaterinenburg month by month, I was much struck with the greater magnitude of the anomalous deviations of the winter as compared with those of the summer months; in other words with the apparent greater variability of pressure during the winter season. In order to verify this feature and to obtain a measure of the variability, I took the mean of the deviation values of each month for the whole series of (31) years, without regard to algebraical sign, and dividing by 2 obtained the results given in the first figure column of the following table. The registers of St. Petersburg, Barnaul, Greenwich, Adelaide, and Melbourne similarly treated gave the results shown in the five subsequent columns, and those of Calcutta and the Mauritius the figures of the two final columns.

	Ekaterinenburg.	St. Petersburg.	Barnaul.	Greenwich.	Adelaide.	Melbourne.	Calcutta.	Mauritius.
	31 years.	31 years.	31 years.	23 years.	3 years.	8 years.	26 years.	18 years.
January	± ·070	± ·089	± ·045	± ·093	± ·024	± ·028	± ·015	± ·017
February ...	·078	·086	·045	·058	·026	·016	·013	·027
March	·062	·060	·031	·075	·021	·014	·012	·020
April	·067	·057	·027	·052	·020	·025	·013	·011
May	·029	·031	·022	·034	·054	·036	·016	·013
June	·033	·029	·024	·043	·066	·049	·010	·016
July	·032	·026	·021	·028	·054	·046	·015	·015
August	·038	·037	·024	·032	·036	·034	·013	·011
September ...	·055	·046	·023	·052	·033	·043	·010	·009
October	·048	·049	·029	·055	·033	·034	·014	·009
November ...	·071	·086	·039	·049	·031	·026	·014	·014
December ...	·096	·098	·047	·089	·016	·015	·010	·018

I am not aware whether the climatic features exhibited by this table have before been noticed, but they seem to have considerable significance. At Calcutta the variability of pressure is nearly the same at all seasons of the year, while at the Mauritius it depends apparently on the comparative frequency of cyclones; but at all the extra tropical stations it is from two to three times as great in the winter months as in the summer, and especially so in the two months December and January. Hence (excluding the case of the Mauritius) the less direct the action of the sun, the greater the vicissitudes of the atmospheric pressure.

The question now presents itself, "How far is that cyclical variation of pressure which conforms to the sun-spot period, dependent on the variation of the summer and winter pressures respectively?" It is obvious that the reply to this question must have a very important bearing in indicating the physical cause of the oscillations. If it be essentially a phenomenon of the summer months, we may be justified in regarding it as a possible effect of the more or less direct action of the sun on the continental land surface; but if it be solely or even mainly dependent on the winter variations, no such explanation is admissible. It must, then, rather be regarded as an effect produced under negative conditions to compensate an opposite effect which is due to the direct action of the sun elsewhere.

To ascertain this I have taken separately the means of the four months November to February, and May to August, for the stations St. Petersburg, Ekaterinenburg, and Barnaul, in each successive pair of years or year; and since the figures thus obtained showed irregularities which somewhat masked the periodical variation, I smoothed the original values by substituting the mean of three consecutive summers or winters for the original mean forming the middle term of the triad. I have also done the same for the tropical stations Singapore, Batavia, and Port Blair, and give the results in the following tables. The smoothed means are illustrated by the six pairs of curves in Fig. 2, the summer and winter curves being drawn to the same horizontal lines of reference, the former dotted, the latter continuous.

RUSSIAN STATIONS.

Year.	Summer means.			Smoothed summer means.			Winter means.			Smoothed winter means.			Year.
	St. Pet.	Ekat.	Barn.	St. Pet.	Ekat.	Barn.	St. Pet.	Ekat.	Barn.	St. Pet.	Ekat.	Barn.	
1847	+·036	+·063	+·014	—	—	—	+·228	+·219	+·078	+·025	+·020	+·005	1847-48
1848	−·033	−·032	+·008	+·006	+·025	+·017	−·144	−·088	−·033	+·037	+·076	+·021	1848-49
1849	+·016	+·045	+·030	+·011	+·024	+·011	+·063	+·097	+·020	−·053	−·052	−·023	1849-50
1850	+·049	+·058	−·004	+·017	+·047	+·013	−·130	−·166	−·054	−·019	+·012	+·012	1850-51
1851	−·015	+·039	+·012	+·030	+·024	−·001	−·010	+·106	+·070	−·057	−·003	+·026	1851-52
1852	+·055	−·025	−·012	+·010	−·005	−·001	−·031	+·051	+·062	+·028	+·050	+·013	1852-53
1853	−·009	−·030	−·004	+·022	+·002	−·006	+·125	−·008	−·093	−·026	+·007	+·088	1853-54
1854	+·019	+·061	−·002	+·019	+·020	−·001	−·172	−·021	+·055	−·012	−·020	−·013	1854-55
1855	+·047	+·030	+·004	−·011	+·019	−·004	+·012	−·032	−·014	−·088	−·039	−·012	1855-56
1856	−·098	−·033	−·015	−·014	−·008	−·009	−·104	−·065	−·090	+·013	+·051	−·053	1856-57
1857	+·008	−·020	−·017	−·017	−·030	−·023	+·131	−·057	−·054	−·014	−·068	−·057	1857-58
1858	+·038	−·038	−·037	+·045	−·028	−·028	−·068	−·082	−·028	+·044	+·002	−·010	1858-59
1859	+·088	−·027	−·031	+·036	−·025	−·031	+·070	+·146	+·051	+·072	+·097	+·014	1859-60
1860	−·019	−·010	−·026	+·014	−·025	−·032	+·214	+·226	+·032	+·092	+·093	+·006	1860-61
1861	−·026	−·039	−·040	−·026	−·067	−·052	−·007	−·092	−·058	+·028	+·063	−·014	1861-62
1862	−·033	−·152	−·091	−·029	−·068	−·068	−·123	+·055	−·030	−·037	−·013	−·014	1862-63
1863	−·029	−·013	−·073	−·039	−·032	−·025	+·019	−·002	+·031	−·017	+·015	−·013	1863-64
1864	−·055	+·068	+·088	−·027	−·002	+·003	+·052	−·007	−·054	+·020	−·025	−·012	1864-65
1865	+·002	−·061	−·006	−·027	+·004	+·026	−·011	−·067	−·026	−·060	−·076	−·023	1865-66
1866	−·028	+·004	−·005	−·011	−·018	+·004	−·221	−·154	−·012	−·134	−·110	−·024	1866-67
1867	−·008	+·004	+·022	+·011	+·003	+·014	−·170	−·110	−·059	−·149	−·092	−·016	1867-68
1868	+·069	0	+·025	+·016	+·040	+·043	−·057	−·013	+·005	−·050	+·039	+·015	1868-69
1869	−·014	+·117	+·081	−·003	+·038	+·036	+·076	+·239	+·114	+·043	+·068	+·024	1869-70
1870	−·063	−·002	+·003	−·046	+·035	+·022	+·109	−·022	−·024	+·098	+·122	+·040	1870-71
1871	−·061	−·009	−·017	−·021	0	−·017	+·108	+·148	+·072	+·084	+·029	−·001	1871-72
1872	+·062	+·011	−·038	−·004	+·003	−·017	+·035	−·040	−·045	−·004	+·036	−·013	1872-73
1873	−·013	+·006	+·003	+·010	+·005	−·013	−·156	−·001	−·065	−·029	+·024	−·015	1873-74
1874	−·019	−·002	−·003	−·001	−·004	−·001	+·035	+·113	+·065	−·017	+·029	−·010	1874-75
1875	+·030	−·015	−·004	+·015	+·015	+·004	+·070	−·025	−·030	+·063	+·039	+·030	1875-76
1876	+·033	+·061	+·019	+·022	+·042	+·036	+·085	+·030	+·056	+·093	+·044	+·081	1876-77
1877	+·002	+·080	+·094	—	—	—	—	—	—	—	—	—	—

INDO-MALAYAN STATIONS.

Year.	Summer means.			Smoothed summer means.			Winter means.			Smoothed winter means.			Year.
	Sing.	Bat.	P. Blair.	Sing.	Bat.	P. Blair.	Sing.	Bat.	P. Blair.	Sing.	Bat.	P. Blair.	
1866	—	0	—	—	—	—	—	−·011	—	—	—	—	1866-67
1867	—	−·010	—	—	+·005	—	—	+·017	—	—	+·015	—	1867-68
1868	—	+·024	+·022	—	+·005	—	—	+·038	+·050	—	+·008	—	1868-69
1869	−·023	+·001	−·006	—	+·002	−·006	−·044	−·030	−·037	—	−·004	−·009	1869-70
1870	−·048	−·020	−·035	−·024	−·007	−·010	−·018	−·021	−·039	−·027	−·021	−·023	1870-71
1871	−·001	−·001	+·010	−·023	−·012	−·024	−·019	−·012	+·006	−·025	−·024	−·022	1871-72
1872	−·020	−·015	−·026	−·014	−·010	−·012	−·037	−·038	−·033	−·011	−·011	−·002	1872-73
1873	−·022	−·013	−·019	−·013	−·014	−·017	+·024	+·018	+·021	0	−·012	−·013	1873 74
1874	+·003	−·013	−·007	−·002	−·012	−·007	+·012	−·016	−·028	+·018	−·005	+·003	1874 75
1875	+·014	−·009	+·004	+·015	−·009	+·001	+·012	−·016	+·015	+·021	+·001	+·010	1875-76
1876	+·029	−·004	+·005	+·028	+·012	+·017	+·032	+·034	+·043	+·028	+·016	+·034	1876-77
1877	+·042	+·047	+·041	+·024	+·013	+·019	+·033	+·029	+·043	+·007	+·018	+·021	1877-78
1878	+·002	−·004	+·012	—	—	—	—	—	−·023	—	—	—	1878 79

In these tables and figures the true nature of the oscillation is sufficiently obvious. At Singapore, nearly on the equator, both seasons of the year show an oscillation of the same kind and nearly of the same amplitude. At the other intertropical stations, both north and south of the line, the difference, if any, is but small. It would appear, however, that both at Batavia and Port Blair, and also at Bombay (judging from the curves given by Mr. Chambers in his communication previously referred to), that the oscillation when the sun is in southern declination is slightly greater than that pertaining to the summer of the northern hemisphere. At the Russian stations, however, the oscillation of the opposite type is entirely restricted to the winter months, and is therefore far more pronounced in the winter curves in Fig. 2 than in the mean annual curves in Fig. 1. Hence it follows that the direct action of the sun on the tropical region is to produce an oscillation such that the pressure is lowest when the sun is most spotted, and it is as a compensation to this action that in the winter season an oscillation of the opposite character is set up on the plains of European and Asiatic Russia; possibly also in the Arctic regions, but this requires verification. Analogy would lead us to anticipate the existence of a similar oscillation in Antarctic latitudes when the sun is in northern declination, but perhaps less concentrated geographically owing to the absence of any dry continental land surface, corresponding to the Siberian and Russian plains. This point must remain for future inquiry.

While on the whole the Russian curves exhibit the oscillation so distinctly and strongly as to leave no room for doubt as to its reality, they show, nevertheless, that it is liable to great disturbances, which at times are so powerful as entirely to neutralise the effect. This will be very apparent if curves be drawn with the original values in the first three columns of the table above given for the winter months; but the most remarkable instance is that afforded by the winter of the year 1877 (at least of the first two months, for I have not yet received the volume of the Russian *Annales* for 1878). The mean pressure of December, 1877, at stations in Western Siberia, exceeded any on record during the whole period of thirty-one years comprehended in the registers before me; and it is not a little remarkable that in the previous July (the mid-winter of the southern hemisphere) an equally excessive, and (in the eight years for which I have registers) unprecedented pressure characterised South-eastern Australia. These accumulations of pressure were, doubtless, intimately connected with the similar phenomenon which characterised the intervening Indo-Malayan region in 1876–78, but the attendant circumstances are as yet by no means fully worked out.

With respect to the nature of the physical causes which produce that alternating oscillation of pressure between the Indo-Malayan region and the Russian plains, which conforms to the sun-spot cycle, our knowledge is still far too imperfect to allow of my attempting any exhaustive analysis. It may, however, be not wholly uninstructive to recapitulate some of the results of recent inquiry which bear upon this point, even admitting, as we must do, that in certain respects they require further verification. Such as they are, they indicate a possible explanation, which I will set forth as briefly as possible.

Among the best established variations in terrestrial meteorology which conform to the sun-spot cycle, are those of tropical cyclones and the general rainfall of the globe, both of which imply a corresponding variation in evaporation and the condensation of vapour. Now the variation of pressure with which we have to deal evidently has its seat in the higher (probably the cloud-forming) strata of the atmosphere. This is not only illustrated in the present instance by the observed relative excess of pressure at the hill stations as compared with the plains, but also follows as a general law from the fact established by Gautier and Köppen, viz., that the temperature of the lowest stratum varies in a manner antagonistic to the observed variation of pressure. It is then a reasonable inference that the principal agency in producing the observed reduction of pressure at the epoch of sun-spot maximum is the more copious production and ascent of vapour, which may operate in three different ways. First, by displacing air the density of which is $\frac{8}{5}$ths greater; second, by evolving latent heat in its condensation; and thirdly, by causing ascending currents, and thus reducing dynamically the pressure of the atmosphere as a whole. The first and second of these processes do not indeed directly reduce the pressure, but only the density of the air stratum, while they increase its volume. In order, therefore, that the observed effect may follow, a portion of the higher atmosphere must be removed, and this will necessarily flow away to regions where the production of vapour is at a minimum, viz., the polar and cooler portion of the temperate zones, and more especially those where a cold dry land surface radiates rapidly under a winter sky. Such an expanse is the great northern plain of European Russia and Western Siberia north of the Altai.

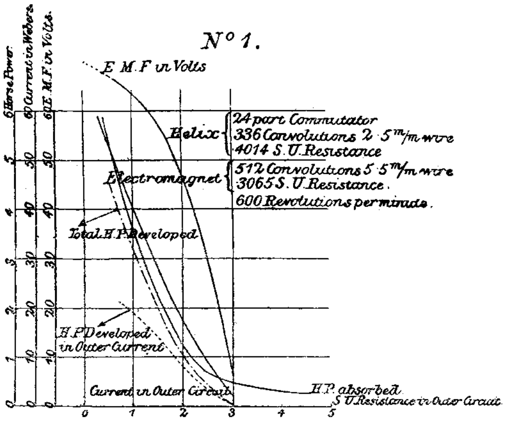
H. F. BLANFORD

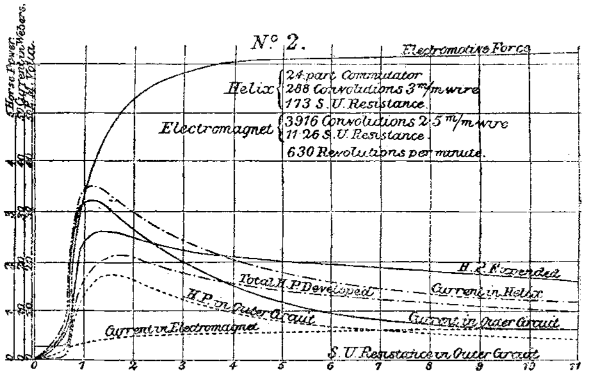
SOCIETIES AND ACADEMIES

LONDON

Royal Society, March 4.—"On the Dynamo-Electric Current and on certain Means to improve its Steadiness." By C. William Siemens, D.C.L., F.R.S.

The author, after alluding to the early conception by Dr. Werner Siemens, of the dynamo-electric or accumulative principle of generating currents, makes reference to the two papers on the subject presented, the one by Sir Charles Wheatstone and the other by himself, to the Royal Society in February, 1867. The machine then designed by him, and shown in operation on that occasion, is again brought forward with a view of indicating the progress that has since taken place in the construction of dynamo-electrical machines, particularly those by Gramme and Siemens von Alteneck. The paper next points out certain drawbacks to the use of these machines, both of them being subject to the disadvantage that an increase of external resistance causes a falling off of the current; and that, on the other hand, the short circuiting of the outer resistance, through contact between the carbon electrodes of an electric lamp, very much increases the electric excitement of the machine, and the power necessary to maintain its motion, giving rise to rapid heating and destructive sparks in the machine itself.





An observation in Sir Charles Wheatstone's paper is referred to, pointing to the fact that a powerful current is set up in the shunt circuit of a dynamo-electric machine, which circumstance has since been taken advantage of to some extent by Mr. Ladd and Mr. Brush, in constructing current generators.

The principal object of the paper is to establish the conditions under which dynamo-electric machines worked on the shunt principle can be made to give maximum results. A series of tables and diagrams are given, the results of experiments conducted by Mr. Lauckert, electrician, employed at the author's